SYSTEMS AND METHODS FOR TRANSPARENT EXPANSION AND MANAGEMENT OF ONLINE ELECTRONIC STORAGE

We claim:

Method

1. A method for expanding storage capacity of an information appliance having a native first storage element; the method comprising:

placing a second storage element in communication with the information appliance;

determining the storage capacity of the second storage element;

merging at least a portion of the capacity of the second storage element with the capacity of the native first storage element.

2. A method according to claim 1, wherein the merging occurs below a file system layer of the information appliance.

3. A method according to claim 1, wherein the act of merging comprises modifying a logical volume table on the information appliance such that the capacity of the logical volume in the logical volume table is equal to the capacity of the native first storage element plus at least a portion of the capacity of the second storage element.

4. A method according to claim 3, wherein the act of merging further comprises modifying a steering table stored in the information appliance to translate between a logical storage element address and a physical storage element address on the second storage element.

5. A method according to claim 1, wherein the second storage element is selected from the group of second storage elements consisting of a hard disk drive, a network attached storage drive, a floppy drive, a USB drive, a CD-ROM, a CD-RAM, and DVD-ROM, a DVD-RAM, an optical storage device, a magnetic storage device, an electronic solid-state storage device, a flash memory device, a molecular storage device, a tape drive, and combinations thereof.

6. A method according to claim 1 wherein the information appliance is selected from the group of information appliances consisting of a computer, a personal computer, an entertainment hub, a game box, a personal digital assistant, a data or information recorder, a data storage system, a data server, a digital camera, a household appliance, an automobile, a

transportation device, a mobile telephone, a communications device, and combinations thereof.

7. A method according to claim 1, further comprising allocating space on the second storage element for storage by the native first storage element.

8. A method according to claim 1, further comprising sharing the second storage element with a second information appliance.

9. A method according to claim 8, wherein the act of sharing comprises merging at least a portion of the capacity of the second storage element with the capacity of a native second storage element on the second information appliance.

10. A method according to claim 1, wherein the second storage element comprises a hard disk drive, a network attached storage drive, a floppy drive, a USB drive, a CD-ROM, a CD-RAM, and DVD-ROM, a DVD-RAM, an optical storage device, a magnetic storage device, an electronic solid-state storage device, a flash memory device, a molecular storage device, a tape drive, and combinations thereof

System

1. A computing system supporting transparent expansion of storage, the system comprising:

an information appliance;

a plurality of storage elements connected to the information appliance;

a device driver operable to communicate with at least one of the storage elements;

a file system accessible to the information appliance, the file system operable to receive a logical address for a storage request and convert the logical address into a physical address;

a steering table accessible to the information appliance, the steering table associating physical addresses with each of the plurality of second storage elements; and

wherein the information appliance is operable to invoke a process operable to receive the physical address, access the steering table and identify the at least one of the second storage elements and call the device driver.

2. A computing system according to claim 1, the system further comprising:

a logical volume table on the information appliance, the capacity of a logical volume in the logical volume table equal to the capacity of a native first storage element plus at least a portion of the capacity of a second storage element.

3. A system according to claim 1, wherein at least one of the plurality of storage elements is selected from the group of storage elements consisting of a hard disk drive, a network attached storage drive, a floppy drive, a USB drive, a CD-ROM, a CD-RAM, and DVD-ROM, a DVD-RAM, an optical storage device, a magnetic storage device, an electronic solid-state storage device, a flash memory device, a molecular storage device, a tape drive, and combinations thereof.

4. A system according to claim 1, wherein the information appliance is selected from the group of information appliances consisting of a computer, a personal computer, an entertainment hub, a game box, a personal digital assistant, a data or information recorder, a data storage system, a data server, a digital camera, a household appliance, an automobile, a transportation device, a mobile telephone, a communications device, and combinations thereof.

5. A system according to claim 1, further comprising at least a second information appliance in communication with at least one of the plurality of storage devices.

Computer Program Product

1. A computer program product for use in conjunction with an information appliance having at least one processor coupled to native storage and a file system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising:

a program module that directs the information appliance to function in a specified manner to transparently add storage, the program module including instructions for:

recognizing addition of a second storage element;

determining the storage capacity of the second storage element;

merging at least a portion of the capacity of the second storage element with the capacity of the native storage; wherein the merging occurs below the file system layer.

2. A computer program product according to claim 1, wherein the merging occurs below a file system layer of the information appliance.

3. A computer program product according to claim 1, wherein the instructions for merging comprise instructions for modifying a logical volume table on the information appliance such that the capacity of the logical volume in the logical volume table is equal to the capacity of the native first storage element plus at least a portion of the capacity of the second storage element.

4. A computer program product according to claim 3, wherein the instructions for merging further comprise instructions for modifying a steering table stored in the information appliance to translate between a logical storage element address and a physical storage element address on the second storage element.

5. A computer program product according to claim 1, wherein the second storage element is selected from the group of second storage elements consisting of a hard disk drive, a network attached storage drive, a floppy drive, a USB drive, a CD-ROM, a CD-RAM, and DVD-ROM, a DVD-RAM, an optical storage device, a magnetic storage device, an electronic solid-state storage device, a flash memory device, a molecular storage device, a tape drive, and combinations thereof.

6. A computer program product according to claim 1 wherein the information appliance is selected from the group of information appliances consisting of a computer, a personal computer, an entertainment hub, a game box, a personal digital assistant, a data or information recorder, a data storage system, a data server, a digital camera, a household appliance, an automobile, a transportation device, a mobile telephone, a communications device, and combinations thereof.

7. A computer program product according to claim 1, wherein the program module further includes instructions for allocating space on the second storage element for storage by the native first storage element.

8. A computer program product according to claim 1, wherein the program module further includes instructions for sharing the second storage element with a second information appliance.

9. A computer program product according to claim 8, wherein the instructions for sharing comprise instructions for merging at least a portion of the capacity of the second storage element with the capacity of a native second storage element on the second information appliance.

10. A computer program product according to claim 1, wherein the second storage element comprises a drive.

11. A computer program product for use in conjunction with an information appliance having at least one processor and a file system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism comprising:

a program module that directs the information appliance to function in a specified manner to access at least one attached second storage element, the program module including instructions for:

receiving a physical address from a file system;

identifying which of a plurality of attached second storage elements corresponds to the received physical address; and

communicating with a device driver for the identified attached second storage element.

12. A computer program product according to claim 11, the program module further including instructions for:

receiving requested data from the identified attached second storage element.

13. A computer program product according to claim 11, wherein at least one of the attached storage element is selected from the group of second storage elements consisting of

a hard disk drive, a network attached storage drive, a floppy drive, a USB drive, a CD-ROM, a CD-RAM, and DVD-ROM, a DVD-RAM, an optical storage device, a magnetic storage device, an electronic solid-state storage device, a flash memory device, a molecular storage device, a tape drive, and combinations thereof.

14. A computer program product according to claim 11 wherein the information appliance is selected from the group of information appliances consisting of a computer, a personal computer, an entertainment hub, a game box, a personal digital assistant, a data or information recorder, a data storage system, a data server, a digital camera, a household appliance, an automobile, a transportation device, a mobile telephone, a communications device, and combinations thereof.